2015

FSAE Rear Diffuser Team

Zarwan Waqar
Virginia Commonwealth University

Sohail Hossini
Virginia Commonwealth University

Saman Usodan
Virginia Commonwealth University

Team Members:
Zarwan Waqar, Sohail Hossini, Saman Usodan
Faculty Advisor:
Dr. Robert Sexton

MECHANICAL AND NUCLEAR

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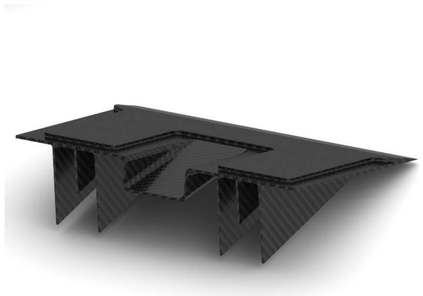
CAPSTONE DESIGN EXPO 2015

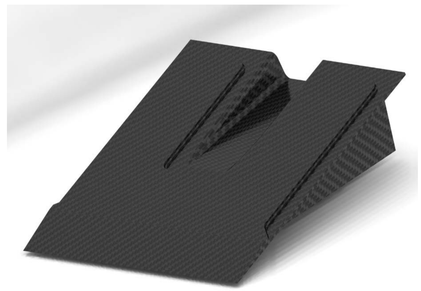
Background / Description

In automotive racing there are many factors that increase the overall performance of the vehicle. Unlike conventional aerodynamics, the real purpose of a racing vehicle's aerodynamics is to generate down force while minimizing the amount of drag force.

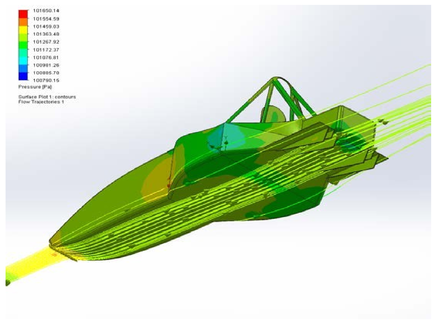
Our senior design project was based around the ground effect, which is used to generate most of the vehicles down force while racing. A flat under tray with diffuser channels was utilized to keep drag at a minimum on the top surface of the car. The ground effect allows the car to create a sufficient amount of down force to the rear of the car, increasing traction and cornering skills. The combination of a flat underbody with the diffuser slits play a key role in increasing the traction generated at the rear.

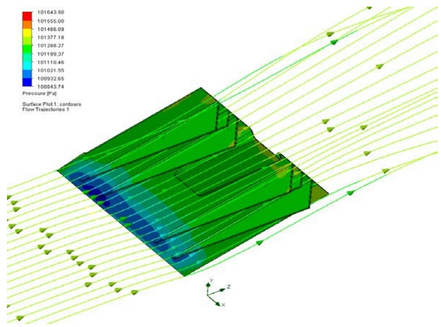
Rear Diffuser / Computational Results





@~65 mph – 11.9 lb_f of drag, 47.5 lb_f down force





Equations / Conclusion

There were several equations that became useful during our analysis phase of the project. The factors that needed to be analyzed in order to have a fully functional diffuser was the drag force, down force, and the differential pressures using Bernoulli's equation.

Drag Force &Down Force

$F_{Drag} = 0.5 * C_D * \rho * A * V^2$ $F_{down} = 0.5 * A * C_L * \rho * V^2$

Bernoulli Equation:

$P_1 + 0.5 * \rho * v^2 + h \rho g = P + 0.5 * \rho * v^2 + h \rho g$

After calculating the down force produced by different diffuser designs, we decided to go with the current design because it produced the most amount of down force (47.5 lb_f). By utilizing this design, we hope to allow for faster cornering speeds when competing in a race.

Thanks To

ANSYS SOLIDWORKS 3D Print RVA VCU Formula SAE RACE TEAM

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